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Dated 3 February 2005





1/77

Date 1st 1977  
File 1/77

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



21 FEB 2004

The Patent Office

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1. Your reference 0400040 23FEB04 E875140-1 G26047  
P01/7700 0.00-0403877.4 NONE
2. Patent application number (The Patent Office will fill in this part) 0403877.4
3. Full name, address and postcode of the or of each applicant (underline all surnames) SMITHS GROUP PLC  
765 FINCHLEY ROAD  
LONDON  
NW11 8DS  
Patents ADP number (if you know it) 8032310001  
If the applicant is a corporate body, give the country/state of its incorporation GB
4. Title of the invention VACUUM CLEANERS AND HOSES
5. Name of your agent (if you have one) J. M. FLINT  
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode) 765 FINCHLEY ROAD  
LONDON  
NW11 8DS  
Patents ADP number (if you know it) 1063304001
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country	Priority application number (if you know it)	Date of filing (day / month / year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:  
a) any applicant named in part 3 is not an inventor, or  
b) there is an inventor who is not named as an applicant, or  
c) any named applicant is a corporate body.  
See note (d)) YES

# Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.

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Continuation sheets of this form

Description

8

Claim(s)

DL

Abstract

Drawing(s)

1 + 1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

J. M. Funt

Date

20 FEB 2004

12. Name and daytime telephone number of person to contact in the United Kingdom

J. M. Funt 020 8457 8220

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## VACUUM CLEANERS AND HOSES

This invention relates to vacuum cleaners and hoses.

Cylinder vacuum cleaners are used with a hose. Upright vacuum cleaners may also be used with a hose where it is necessary to clean less accessible locations. Hoses are also used in central vacuum cleaner installations, where a suction unit and ducting is built into a building. A long hose is useful in some situations but causes problems with storage and manipulation. The length of a hose is usually a compromise between a long length for ease of use and a short length to facilitate storage. One form of hose that can be long yet is easy to store is the extensible or stretch hose, which has a naturally short length but can be pulled to extend it to a longer length. The hose has a helical reinforcement with a natural contracted length but which can be extended resiliently. Although these hoses can be used satisfactorily, they have a disadvantage because the force needed to extend the hose and to maintain its extension makes it more difficult to manipulate the cleaning head. Furthermore, the force may pull over or move the vacuum cleaner or any furniture around which the hose is lead. One solution to this is the retractable hose, which has a naturally extended length and which can be retracted by suction. This is achieved by selecting the resilience of the helical reinforcement of the hose so that the suction created by the vacuum cleaner when the far end of the hose is obstructed is sufficient to pull the hose to a retracted length. The hose is then held in its retracted state so that it does not extend when the vacuum cleaner is turned off. This form of retractable hose is described in WO 03/024294. Although this form of hose has many advantages, there may be situations where it is desirable to have a hose that can be extended to even longer lengths but without an increased storage length, or where the

construction of the hose does not allow for it to be retracted by suction, or where a non-retractable form of hose is preferred.

It is an object of the present invention to provide an alternative vacuum cleaner and hose.

According to one aspect of the present invention there is provided a vacuum cleaner having a flexible hose assembly connected therewith, the hose assembly including at least two flexible sections one of which has a smaller external diameter than the other and is slidable within the other, the smaller diameter section having sealing means towards one end adapted to seal with the larger diameter section at least when the two sections are extended relative to one another.

The two hose sections are preferably corrugated. The smaller diameter section may be of a non-compressible, stretch or retractable construction where its length can be retracted by suction applied by the vacuum cleaner when the end of the hose assembly is occluded. With a retractable construction, the smaller diameter section may be retractable from a first length greater than that of the larger diameter section to a second length substantially equal to that of the larger diameter section.

According to another aspect of the present invention there is provided a hose for a vacuum cleaner according to the above one aspect of the present invention.

According to a third aspect of the present invention there is provided a hose assembly including two sections that are corrugated and flexible and have a first end and a second end, one of the sections having a smaller external diameter than the other section and having its first end slidably located within the other section and being extensible from a first position where the first end of the two sections are located adjacent one another to a second position where the first end of the one section is located adjacent the second end of the other section, the first end of the one section being adapted to seal with the second end of the other section in the second position.

A method of using a vacuum cleaner having a hose assembly having at least two flexible sections one slidable within the other, including the steps of extending the two sections such that they seal with one another, using the hose assembly to clean, and subsequently withdrawing one section within the other.

A vacuum cleaner including a hose assembly and its method of use, according to the present invention, will now be described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a simplified perspective view of the cleaner and hose assembly in an extended state; and

Figure 2 is a simplified enlarged cross-sectional view of a part of the hose assembly in an extended state.

With reference first to Figure 1 there is shown a vacuum cleaner including a suction unit 1, a hose assembly 2 and a cleaning wand 3 with a cleaning head 4 at one end.

The unit 1 is conventional, being a portable cylinder cleaner with a pump, dust collection bag, controls and filters of the usual kind (not shown). The unit 1 has a suction inlet 10 towards one end to which the hose assembly 2 is connected.

The hose assembly 2 has a first section 20 with a coupling 21 at one end connected with the suction inlet 10. The main part of the first section 20 is provided by a corrugated, flexible tubular wall 22 of a plastics material, which is reinforced by a helical wire 23. The invention is also applicable to other forms of hose, such as those made entirely of plastics. The end of the first section 20 remote from the vacuum cleaner housing 1 is terminated by a sealing coupling 24. The first section 20 of the hose assembly 2 is typically about 1.8m long and is relatively inextensible axially. The first hose section 20 may be of a stretch construction, that is, one that has a natural retracted length but can be pulled to a greater length against the axial resilience of the hose.

The hose assembly 2 also has a second section 25, which is flexible and corrugated, being provided by a sleeve 26 of a highly flexible plastics material supported on the outside of a helical reinforcement member in the form of a spring metal wire 27, as described in WO03024294. The helical reinforcement wire 27 has a natural extended state but can be compressed axially against its resilience by an applied external force. The sleeve 26 is sufficiently flexible that the second section 25 itself naturally takes up the extended length of the reinforcement wire helix 27. The sleeve 26 has shallow hills extending outwardly



between turns of the reinforcement wire 27, thereby allowing the sleeve to fold outwardly when the hose is retracted. The second section 25 is terminated at one end by a rigid circular end fitting 28 located within the first section 20 and freely slidable along it. The dimensions of the end fitting 28 and the coupling 24 on the first section are such as to prevent withdrawal of the end fitting. The end fitting 28 and the coupling 24 have engaging sealing surfaces 29 and 30 that contact and seal with one another when the end fitting is pulled against the coupling. The natural, extended length of the second section 25 is about 3.6m and it can be retracted to a length of about the same as that of the first section, that is, about 1.8m. This gives a total length of about 5.4m. In general, if both sections of the hose are non-retractable or non-compressible the minimum overall length of the hose will be about 50% of its maximum length. Where one of the hose sections is retractable, as described above, the same maximum length can be achieved but the minimum length can be only about 25% of the maximum.

The opposite end of the second section 25 is terminated by a handle 32, such as of the kind described in GB0314673.5. The rear end of the handle 32 is formed with a coupling 33 adapted to mate with the coupling 24 at the end of the first section 20. The handle 32 has a trigger 34 that can be operated by the user to close a valve (not shown) within the handle and thereby prevent or restrict flow of air through the handle and hence along the hose assembly.

2. The cleaning wand 3 is connected to the forward end of the handle 32.

Before use, the second section 25 is retracted and withdrawn within the first, outer section 20, as shown by the broken lines in Figure 2, and is held in this retracted state by engagement of the couplings 33 and 24, thereby providing a relatively compact configuration

for storage. The hose assembly 2 can be used in this compact configuration for cleaning where a longer length is not needed. A stretch construction of the first section 20 facilitates use in this compact configuration. Normally, however, the user would release the two couplings 33 and 24 so that the resilience of the second section 25 extends it to its natural extended length. The user then pulls the second section 25 slightly to pull it out of the first section 20 to its maximum extent, in a telescopic fashion. Until the end fitting 28 is pulled into sealing engagement with the coupling 24, air will be able to flow between the outside of the second section 25 and the coupling on the first section 20, so the suction effect at the cleaning head will be reduced. Once the end fitting 28 is engaged with the coupling 24, a seal is formed preventing leakage of air into the hose assembly except at the cleaning head 4. The total length of the extended hose assembly 2 is, therefore, equal to the combination of the length of the first section 20 and the extended length of the second section 25, that is, about 5.4m. It will be appreciated that, if the first, outer section 20 has a stretch construction, the overall effective length of the entire hose assembly can be further extended by applying a light pulling force to the remote end of the assembly.

When the user has finished cleaning and wishes to store the cleaner, he closes the trigger 34 on the handle 32 to restrict air flow along the hose assembly 2. This creates a suction pressure within the hose assembly 2 thereby retracting the second section 25 in length. The suction also has the effect of withdrawing the second section 25 back into the first section 20, telescopically, like a piston. Once the end fitting 28 is displaced from the coupling 24 some air will flow into the first section 20 at the coupling but it is still easy for the user fully to retract the second section 25 into the first with the combination of the suction and some manual guiding and pushing. When the second section 25 has been withdrawn fully

into the first section 20 and has been retracted in length, the coupling 33 on the handle 32 is engaged with the coupling 24 on the first section. The vacuum cleaner can now be turned off allowing pressure within the hose assembly 2 to rise to atmosphere. The tendency of the second section 25 to extend is restrained by engagement of the couplings 33 and 24.

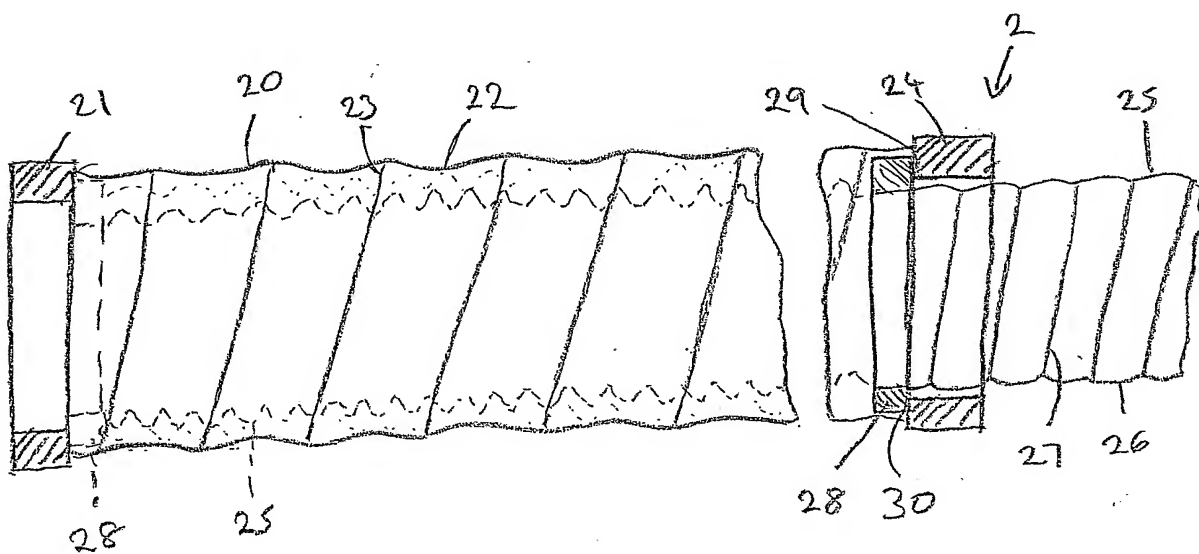
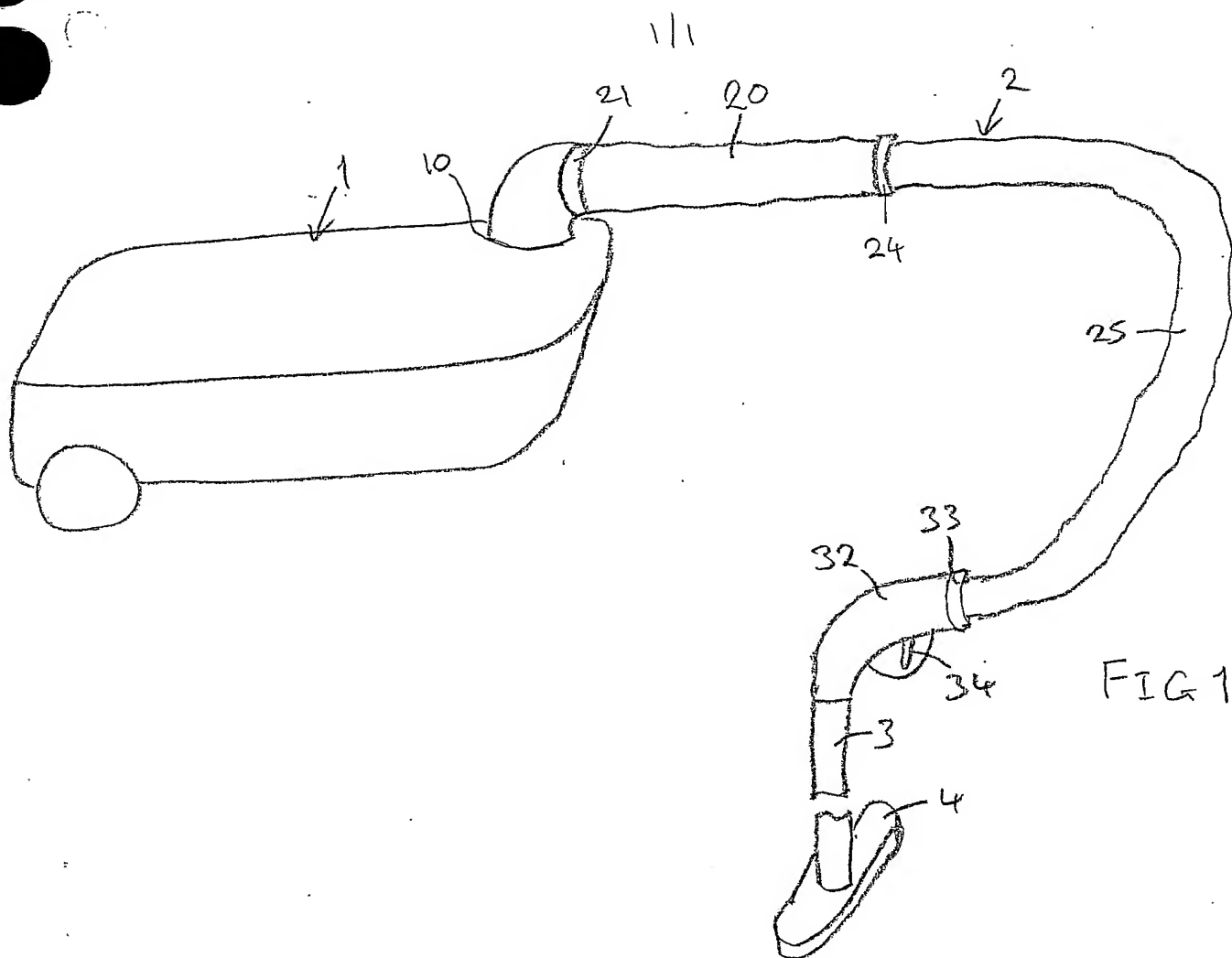
By providing for the second section 25 to slide within the first section 20 the overall effective length of the hose assembly 2 can be further extended over the arrangement described in WO03024294 without any increase in the stowed length of the hose assembly. Or, the same extended length can be achieved with a hose assembly having reduced stowed length.

The invention could also be used with conventional hoses that cannot be extended or retracted in length. In the simplest case, the user would simply pull the smaller diameter hose out of the larger diameter hose to its full extent when cleaning and would push the two hoses telescopically together when the vacuum cleaner is to be stored. This enables the effective usable length of the hose to be twice that of the stowed length. In a modification of this arrangement employing conventional hose sections, the remote end of the hose assembly could have a valve similar to that described above that the user can close so that suction is created within the hose assembly. The suction helps produce a telescopic piston effect to withdraw the smaller diameter hose into the larger diameter hose.

It will be appreciated that the hose assembly could have various different configurations. For example, the hose assembly could include three or more hose sections of different diameters nested one within the other, so that the effective, usable extended length

of the hose is three or more times the stowed length. The larger diameter section could be secured at the remote end of the hose assembly and the smaller diameter section secured with the vacuum cleaner housing. The hose need not have a wire-reinforced construction but could, for example, be a low cost hose made entirely of plastics material.

The invention is not confined to portable cylinder cleaners but could be used with upright cleaners, central vacuum cleaner installations, fixed garage forecourt vacuum cleaners or the like.



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